Qweak Cooling Power Requirements

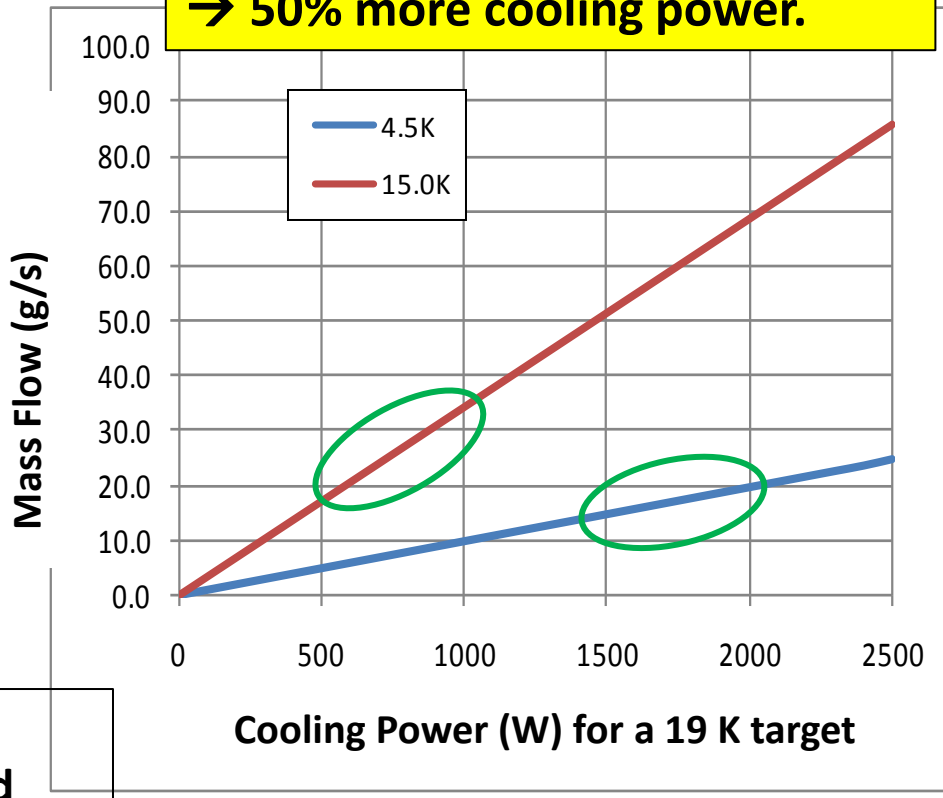
$P_b(W) = I_b(\mu A)\ \rho(g/cm^3)\ t(cm)\ dE/dx(MeV/g/cm^2)$

With: I_b=180 μA, ρ=0.072 g/cm^3, t=35 cm, → **P_b=2.1 kW!**

Cooling Power Budget

Pump efficiency	60%	
Flow rate (liters/s)	15	
Pump Head (psi)	1.3	
Pump Power (hp)	0.5	
Beam Current (uA)	180	150
Beam Power (W)	2120	1767
PID reserve (W)	150	150
Pump heat (W)	75	75
Viscous heating (W)	224	224
Conductive Losses (W)	50	50
Total Load (W)	2618	2265

Note: If 15K supply actually 13K, → 50% more cooling power.



Note: New ESR recovery HX will improve ESR capability by recovering our otherwise unused returning 4K enthalpy.